



Feasibility of Goat Production in West Virginia

A Handbook for Beginners

By
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Cover Image

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Introduction

The meat goat industry is the fastest growing animal industry in the United States (US). The US goat industry is predominantly an infant industry with considerable growth potential. Sales of goat meat (chevon) throughout the US and particularly in the Northeast have risen dramatically since the early eighties and are at an all time high. The Northeast market is the largest consumer base for chevon with demand emanating from ethnic markets, and the health and gourmet food sectors. Because of the persistence in maintaining cultural practices, the demand for goat meat among ethnic groups is thought to be relatively inelastic. Further increase in demand is projected as the size and purchasing power of ethnic populations grow. Growth potential also exists in the health and gourmet food sectors because of the unique taste and relative 'healthful' nature of goat meat. However, many goat producers nationwide are limited by the availability of accessible markets, suitable and sufficient land and technical know how. Such limitations can depress or delay supply response, even in the face of favorable prices.

Goat production has the potential to become an economically viable option for small full-time farmers and the growing number of part-time farmers in the Northeast region. Several factors support this assumption, including increasing demand in the Northeast, lower cost of production compared with other livestock, and the ability of goats to effectively utilize poorer quality forage.

Pennsylvania (Philadelphia), New York, New Jersey and Washington DC (the urban Northeast) are major goat meat consumption areas within the Northeast. West Virginia (WV) is well positioned geographically to supply goats to these areas with high demand. However, an inadequate supply of chevon year round, low prices, as well as inconsistencies in meeting specific consumer preferences limit the expansion of the goat meat industry in the Northeast. Overall, limited information is available on the Northeast goat industry, research and extension is lacking, as is appropriate information to guide producers' management decisions. This bulletin begins to address some of these deficiencies by initially examining the feasibility of goat production for producers in WV.

Advantages of Meat Goats Production Systems

1. Demand for goat meat in the US is increasing; since 1994, there has been an increase in goat meat imports at a rate of 30% annually and domestic slaughter has more than doubled since 1980.
2. Annual price paid per pound of goat meat has increased over the last five years, increasing by \$0.15 in the last two years alone.

3. Sheep production continues to decline nationally and threatens the existence of small family farms. With growing evidence of rising goat consumption, resources can easily be converted from sheep to goat enterprises, making goat production an economically viable option for small farm families in the region.
4. Goats require comparatively fewer resources (labor and buildings) than other livestock thereby enabling the small part-time farmer to be efficient, competitive and profitable.
5. Goats are efficient converters of low quality forages to meat, milk and hide products, requiring less of other feed sources such as corn and other processed feed.
6. Goats forage on a broader range of plants than do other small ruminant livestock and survive well on poor or fair grazing areas (with sufficient grazing material) because they are proficient at selecting the most nutritious parts of the plant.
7. Goats are excellent browsers and forage from the top down, which makes them efficient biological controls for weeds while substantially increasing vegetative cover by favorable grass and legume species.
8. Reducing the geographic disparity between areas of goat production, goat processing and goat meat consumption could reduce consumer costs, increase demand, and so improve the industry over time.
9. Ethnic populations that require live goats and goat meat for religious and cultural reasons are increasing. Ethnic restaurants, where goat meat consumption is common, are a fast-growing segment of the food industry.
10. Of all red-meat species, only goat meat consumption has increased significantly over the last two decades. Compared to other meats, chevon is lower in calories, total fat and saturated fat, higher in protein content and easily digestible.
11. Effective reproductive management can allow for year-round goat production.

Disadvantages of Meat Goat Production Systems

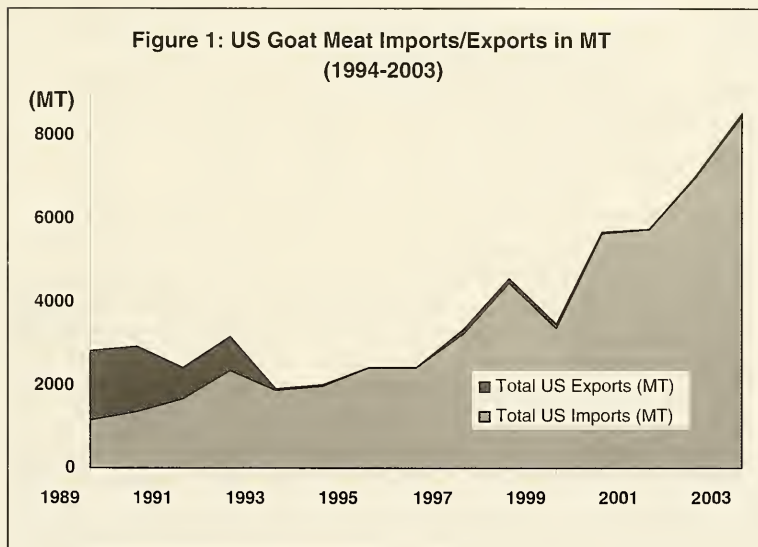
1. Overall consumer demand for goat meat in the US is relatively low and geographically localized, and per capita consumption among current buyers of goat meat is also low.
2. Goat meat is largely absent from grocer's shelves because most major chains need a guarantee of availability, price and product consistency year round.
3. Seasonality of reproduction in goats negates the year-round availability of chevon.
4. Limited information is available to WV producers regarding production, management and marketing of goat enterprises, making them reluctant to shift from more traditional livestock enterprises such as beef, dairy and sheep.
5. Areas of low cost production (Texas, Oklahoma and the Southern US) and the areas of relatively high goat meat consumption are widely separated.
6. Goat production in WV is disadvantageous compared to production in Texas and Southeast US where the weather is more amenable, the grazing season is considerably longer, less supplemental feed is necessary, and goat housing is simpler/cheaper.

7. Seasonality of demand, relatively high marketing costs, competition from traditional red meats, erratic carcass quality, commercial trade resistance, and uninformed consumer attitudes are other factors limiting growth in the goat industry.

The Goat Industry

Goat Meat Demand (Domestic Slaughter, Imports and Exports)

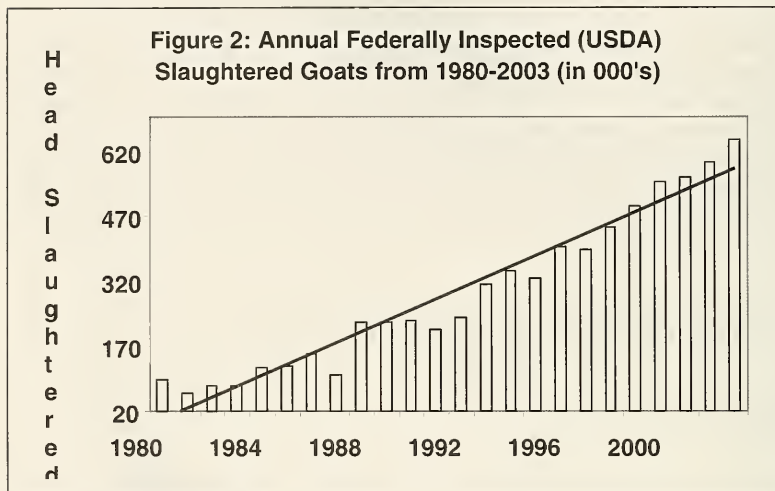
Goat meat is consumed readily in other parts of the world, and in the US, consumption is on the increase. In 1994, imports of goat meat into the US surpassed exports and since then, the US has remained a net importer of goat meat. Approximately 98% of goat meat imported into the US originates in New Zealand and Australia. Since 1994, there has been a linear annual increase in goat meat imports (at an annual rate of more than 30%) while exports of goat meat have decreased at an increasing rate (Figure 1).¹ This makes the goat industry the fastest growing industry in terms of meat consumption in the US.



USDA statistics indicate that imports of goat meat (fresh, chilled and frozen) have steadily increased from 1994 reaching 19 million pounds (8,468 metric tons) in 2003 for a total value of \$21.48 million (Figure 1). Numbers of domestic annual federally (USDA) inspected slaughtered goats also have seen steady annual increases. Recorded slaughter of goats in the US has increased 270% since 1994, reaching approximately 647,000 head (20

¹ Since 1994, much of the domestic exports to Canada, Mexico and the Caribbean are now being reserved to satisfy domestic demand (FAS 2004)

million pounds or 9,075 metric tons) in 2003 (Figure 2).² The domestic slaughter is thought to be underestimated, because it does not account for goats passing through other slaughter channels, namely state-inspected slaughter facilities and on-farm slaughter. It is estimated that over a million goats are slaughtered for personal use or back yard slaughtering, with this figure not being reflected in the published total.



Annual Price Variations in the US

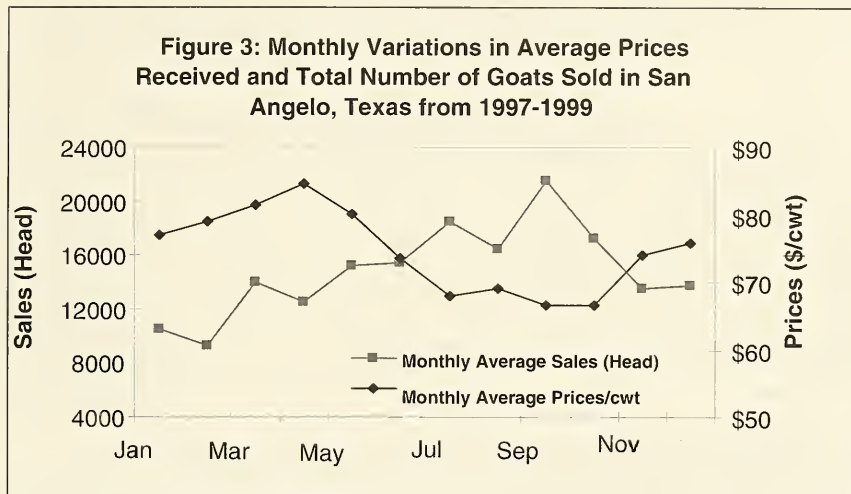
In most traditional goat rearing areas, because of the seasonality associated with reproduction in goats, the market becomes glutted with chevon in mid and late summer, lowering prices received by farmers. This results in recurring supply and pricing patterns across years, as shown in Figure 3.

Monthly sales of goats traditionally peak in the fall and early winter months, with prices correspondingly low in this period. Once the traditional group of goats exits the market chain, supply then decreases throughout the remainder of the year and prices begin an upward trend, starting in October and continuing through May. Prices usually peak during February and March, tied to the low availability and various ethnic holidays that fall during this time period. Increased demand at Christmas and Easter has an additive effect on producer and consumer prices during these low supply months. Imported goat carcasses are used to fill these seasonal voids and annual shortfalls.

Very little information exists at the national level on prices received by producers for live goats or goat products. One of the only states that have maintained a record of goat's prices is Texas. Prices received by farmers in San Angelo, Texas during 1997-1999

² Local production represents only animals slaughtered at a federally (USDA) inspected slaughter facility. No statistics on state-inspected slaughter or on-farm slaughter were available. The slaughter quantities were calculated on a 30 lb carcass equivalent. Imports were converted at a rate of 1 MT = 2204 lbs.

ranged from \$0.55 to \$0.99 per lb., depending on body condition and general conformation. But speculations, given some insight from other state livestock auctions, indicate that prices may have increased over the last few years because demand continues to outstrip supply.



Price responses to differences in quality for the San Angelo, Texas market are shown in Figure 4, where the three quality levels (good, choice and prime) reflect increasing body condition and general conformation of goats offered for sale. In San Angelo, Texas, price differentials range from \$16 - \$30 per cwt. between the lowest and highest grades, and reflects the buyers' expectation of the value of the carcass. In the Northeast, there may be higher demand for lighter goats, because of the preferences of ethnic markets, resulting in a reversal of the price patterns in Texas.

Average price received for imported frozen goat meat has experienced an annual increase of \$0.15 per lb. from two years ago (FAS 2004) (Figure 5). According to Johnson (2002), "a Pennsylvanian importer claims that he can have an imported frozen goat carcass delivered to his plant for \$1.50 (\$1.20 /lb. for the meat and the remainder includes handling and delivery from the port)". Imported goat meat prices set the floor for domestic prices, and currently there are no quotas for imported goat meat.

Where is the Demand (Niche Markets)?

Cuisine from goat consuming cultures has grown in popularity with an increasingly cosmopolitan US mainstream population. The healthy profile of goat meat is attractive to today's consumer. The goat cheese industry has done a lot to destroy the public's inhibitions against goat products and many people who pride themselves on a discerning palate are interested in trying goat meat. The 'yuppie' community that prefers gourmet foods includes many major goat meat consumers because of goat meat's unique taste. The

health food sector prefers goat meat because of its superiority in terms of protein, fat and calorie content, and potential use as therapeutic aids in diseases, including cardiovascular diseases (Gibson, 2002; Addrizzo, 2000).

Figure 4: Seasonal Prices (\$/cwt.) of Slaughter Goats (40-80 lbs) Live Weight, San Angelo, Texas.

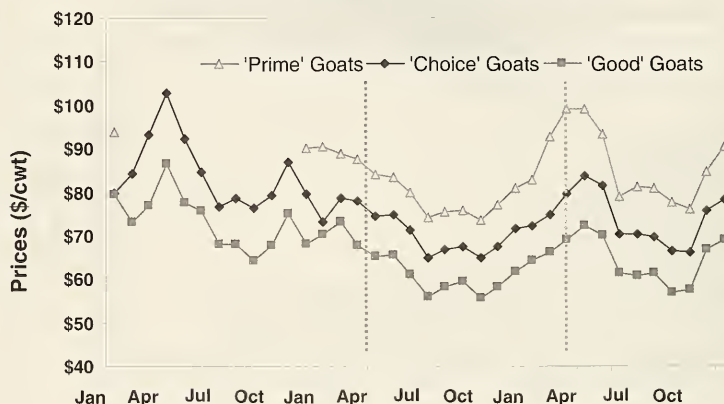
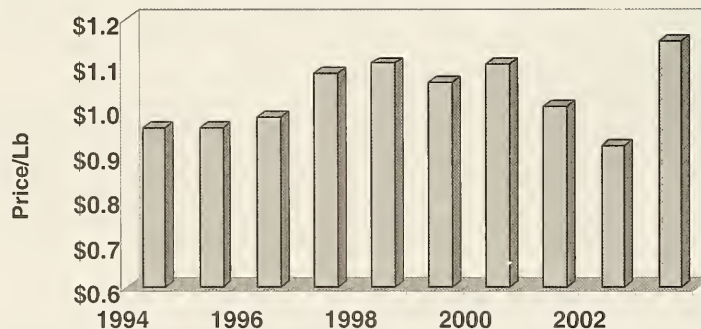


Figure 5: Price Paid per Pound of Goat Meat Imported into the US (1994-2003)



Goat meat cuts were found to have fat content 50%-65% lower than similarly prepared beef (but with a similar protein content), between 42%-59% less fat than lamb and about the same fat to 25% lower than veal. This pattern was repeated for cooked samples, as illustrated in Table 1 (James et al., 1990). In addition, the percentage of

saturated fat in goat meat is 40% less than chicken (without skin) and is far below (almost ten times below) beef, pork and lamb (U.S.D.A., 1989). Addrizzo (2000) suggests the goat's genetically determined distribution of body fats and composition of these fats (low saturated: high polyunsaturated/saturated fat ratio) enable it to be considered "user friendly" in our modern, health-conscious society. Of all red meat species, only goat consumption has increased significantly over the last two decades. The others have either remained steady or declined.

Table 1: Comparison of Goat Meat to Other Meats (3 oz. roasted)

Animal Specie	Calories	Total Fat (grams)	Saturated Fat (grams)	Protein (grams)
Goat	122	2.58	.79	23
Beef	245	16.00	6.80	23
Pork	310	24.00	8.70	21
Lamb	235	16.00	7.30	22
Chicken	120	3.50	1.10	21

Source: Meat Goats Production, Extension Animal Husbandry, Department of Animal Science, NCSU

Myriad ethnic groups are large goat meat consumers. Ethnic demand for goat meat may be related to cultural traditions or religious affiliations. Because of this, there are some discernable seasonal demand patterns coinciding with specific holidays. When contrasted against the seasonal supply patterns, numbers and characteristics (sizes and weights) of goats offered for sale are highly variable during certain months.

Goat meat is consumed over the entire year by some ethnic consumers as well as by the health and gourmet food sectors. Imports, especially from New Zealand and Australia are generally used to assuage seasonal as well as aggregate annual supply shortfalls.

Where is the Demand (Geographical Location)?

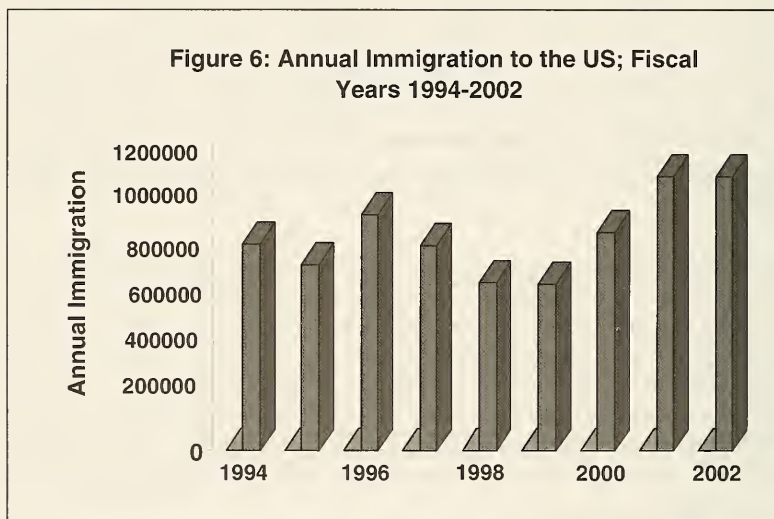
Prior to 1992 (the last year before federal privacy law effectively closed slaughter figures to the public), approximately 67% of the goats killed in federally-inspected plants was confined to the Northeastern region. Substantial numbers of goats were also killed by a variety of other situations and were consumed in the northeast. The largest goat-consuming ethnic populations in the U.S. are Hispanics, Muslims and Caribbean Islanders.

Overall goat meat demand in the US is strongest among Muslim markets. The largest single Muslim market is Detroit, followed by southern California and the northeast corridor stretching from Washington DC to Boston (Pinkerton et al., 1994 [A]; Pinkerton et al., 1993; Gibson, 2002). The geographic disparity between areas of goat production and goat processing and consumption adds substantially to marketing costs and retail prices for these ethnic consumers. Increasing production in areas closer to goat meat consumers (east coast ethnic markets for WV and surrounding producers) could reduce both producer and consumer costs and can help improve long-term prospects for the goat industry. WV and surrounding regions have comparative advantages in goat production

capability and in proximity to east coast ethnic, health and gourmet food sectors relative to the traditional southwestern areas.

Is Demand Growing?

Overall ethnic demand for goats appears poised to increase due to expected population increases and improvements in purchasing power through upward mobility of these groups. Ethnic populations that require live goats and goat meat for religious and cultural reasons are increasing due to increasing immigration. Over the last decade (1991-2000), immigration to the US has increased by 20% over the previous decade (1981-1990) (Figure 6). As more immigrants come to the US, the demand for goat meat increases.

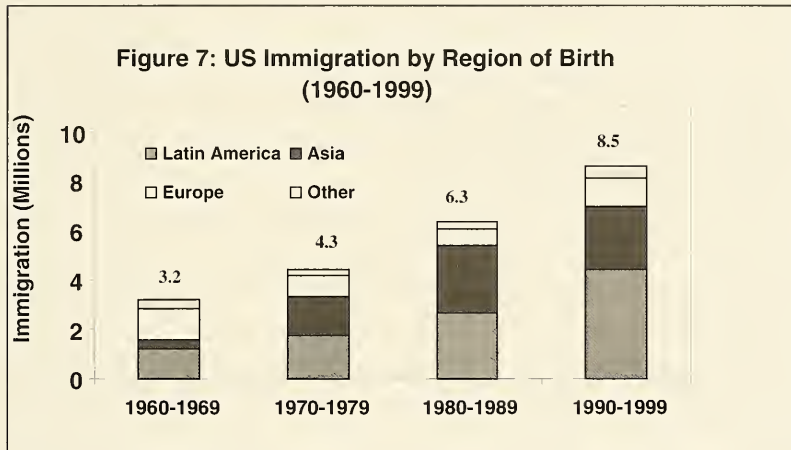


The American Religious Identity Survey conducted in 2001 estimated that during the period 1990-2000, the US Muslim population more than doubled, increasing by 109 percent (Kosmin et al., 2001). By the year 2010, growth in the US Muslim population will translate into Islam becoming the second largest organized religion in the US following Christianity (Power, 1998). If the Muslim population and markets in the region do in fact continue to grow, they could have a pronounced effect on regional demand and supply patterns for goat meat.

Ethnic restaurants, where goat meat consumption is common, are a fast-growing segment of the food industry. While restaurant patronage in the US increased by only 10% in a four-year period, rates increased by 43% for Mexican restaurants and 54% for Asian restaurants. These figures correspond to increases in immigration from these regions (Figure 7). The number of Mediterranean restaurants has also increased. In most of these restaurants, Chinese, Mexican, Mediterranean and Italian dishes are most frequently served, and goat meat consumption is common to all four cultures. These consumers

however, are classified as ‘price sensitive’, shifting to less expensive cuts or to lamb to avoid high goat prices (Gibson, 2002).

The economic concept of “elasticity” measures the sensitivity between changes in production and prices and ultimately determines supply. The supply of meat goats seems rather elastic, that is, sustained improvements in prices offered would result in increases in the production of meat goats because of the potential producer profits. In summary, the supply function for meat goats in the US is shifting upward and appears to be elastic in nature. Demand is also shifting upwards. All indications predict a growing industry.



Timing Seasonal Sales

Retail sales of goat and goat products to ethnic communities in the US are seasonal in nature and tied to religious holidays. Each year, Jewish and Christian holidays fall on a particular date on the western/Gregorian calendar (e.g. the Christian celebration of Christmas) or during a particular time frame (e.g. the Jewish celebration of Rosh Hashanah, September/October; and the western Christian celebration of Easter, March 22-April 25). In contrast, on the western calendar, Muslim holidays move back approximately eleven days each year. This occurs because the Muslim/Islamic calendar, the Hijra, is a lunar calendar, whereas the Gregorian calendar is a solar calendar. Table 2 provides an overview of when these holidays are celebrated for the period 2005-2010.

The three primary Muslim observances that have the greatest impact on the demand for goats in the Northeastern region are: 1) Ramadan, 2) Eid al- Fitr, and 3) Eid al-Adha. During recent years (1996-2004), both Easter and Eid al-Adha have occurred during either the month of March or April - thus increasing market competition during periods of limited supplies of goats. Reproductive management (out-of-season breeding) can be used to allow producers to have animals ready to capitalize on these markets.

Consumers in niche markets, especially in the Northeastern ethnic markets, vary in their preferences for specific weights and carcass characteristics, especially the ethnic eastern markets. These preferences are summarized in Table 3. Ethnic markets require a

lighter carcass or even live goats, while the restaurant markets require a heavier carcass. It is important that producers educate themselves about the types of goats that are popular for various seasons. It is important for producers to communicate well with their buyers to make sure they are accurately representing their animals and matching the animal to the market demand.

Table 2: Dates for Ethnic Holiday Observances: 2005-2010

Holiday	2005	2006	2007	2008	2009	2010	Type of Lamb Required
Christian Holidays							
Palm Sunday	Mar 20	Apr 09	Apr 01	Mar 16	Apr 05	Mar 29	- 20-50 lbs. (less than 3 months old) and milk-fed
Good Friday	Mar 25	Apr 14	Apr 06	Mar 21	Apr 10	Apr 02	
Western Easter	Mar 27	Apr 16	Apr 08	Mar 23	Apr 12	Apr 04	
Eastern Easter	May 01	Apr 23	Apr 08	Apr 27	Apr 19	Apr 04	
Christmas	Dec 25	Dec 25	Dec 25	Dec 25	Dec 25	Dec 25	- 18-40 lbs., milk-fed and fat
Islamic Holidays							
Start of Ramadan	Oct 04	Sept 24	Sept 13	Sept 02	Apr 22	Sept 24	- 45-120 lbs., less than 12 mts.
Eid al- Fitr	Nov 03	Oct 24	Oct 13	Oct 02	Sept 21	Oct 24	
Eid al- Adha	Jan 20-22	Jan 10-13	Dec 31- Jan 03	Dec 20-23	Dec 08-12	Jan 10-13	- 60-100 lbs., yearlings, blemish free
Jewish Holidays							
Passover	Apr 24-31	Apr 13-14	Apr 03-04	Apr 20-26	Apr 24-26	Mar 30-31	- 30-55 lbs., milk-fed and fat
Hanukkah	Dec 25	Dec 16	Dec 12	Dec 22	Dec 12	Dec 07	
Rosh Hashanah	Oct 04-05	Sept 22-23	Sept 12-13	Sept 29-30	Sept 19	Sept 09	

Sources: Mall Area Religious Council Interfaith Calendar, 2005-2010, <http://www.interfaithcalendar.org/index.htm>, Sept 23, 2004.

General Management Practices

Breed Selection

Because of the infancy of the goat industry in the US, delineation of goat breeds by purpose has been somewhat premature. The following are breeds used in other goat producing regions that may be suitably used in the US. The key traits to be considered in selecting a breed for meat goat production include: adaptability to environmental conditions, reproductive and growth rate, and carcass characteristics.

Meat-Goats

Boer: The Boer was developed in South Africa and has excellent growth and fertility rates, and good body conformation. This makes the Boer a good fit as a terminal sire in a crossbreeding system. Puberty is achieved early, at about 6 months for the males

and 10-12 months for the females. A mature Boer buck weights between 240 and 300 pounds and the Boer doe weighs between 200 and 225 pounds, with average daily gains of between 0.3 to 0.4 pounds. For some situations, this breed might be too big, with high maintenance costs. This breed is prolific with average kidding rates of 200 percent. The Boer goat has an extended breeding season, which makes fall kidding and three kiddings every two years possible.

Table 3: Market Goat Live Weight Preferences for Selected Northeastern Markets

Market	Wgt./Age Preference	Other Preferences
Italian	18-28 lbs (4-12 weeks)	▪ May be flexible in size but younger goats preferred
Greek	30-40 lbs (8-16 weeks)	▪ May be flexible in size but younger goats preferred
Muslim (Year Round)	50-70 lbs (under 12-14 months)	▪ Kids milk teeth only. ▪ Leanness is essential
Muslim (id-al-Fitr Festival – Breaking Fast)		▪ Yearling goat (two permanent teeth only) ▪ No blemishes or deformity ▪ Uncastrated
Chinese (Restaurants)	60-80 lbs	▪ Sold with hide on but hairless (scalded in the manner of swine processing)
Hispanic	Varies	▪ Cabrito (small goat/veal kids) weighing 15-25 lbs live (4-10 weeks), which have received only milk receive premium prices
West Indians and West Africans	Varies	▪ Use ‘bone-in’ cuts for stews, soups and stews ▪ ‘Cubed bone-in” pieces 4-6lbs/package from older, lower condition goats are taken. ▪ Mature bucks and goat heads are used for their purported aphrodisiac qualities.
Restaurant	80-100 lbs	▪ Larger, tender, well-muscled, free of intramuscular fat.

Source: Northeast Sheep/Goat Market. Project, <http://www.sheepgoatmarketing.org/>

Kiko: The Kiko breed was developed in New Zealand from feral and New Zealand dairy goats and continues to be selected for specific commercially-important traits. During its development animals were selected for rapid growth rates, high fertility, early maturity, extended breeding season, ease of kidding, soundness of feet, good male virility, ease of maintenance, including the ability to withstand periods of nutritional stress, and resistance/tolerance to infestation by internal parasites. The Kiko goat is therefore well suited to forage-based meat production systems and can perform well under a variety of conditions. They have good reproductive rates, growth rates, and comparable mature weights.

Spanish: Generically, the term Spanish have been used to describe goats of unknown ancestry. Because of this, body shape, size and color are not consistent among goats of this breed. Because they have been crossbred for many generations, they are very hardy, and can survive under adverse agronomic climates. They are excellent range animals because of their small udders and teats. The Spanish goat is a non-seasonal breeder, which makes three kiddings every two years possible. On average, mature bucks can weigh up to 200 pounds and does up to 130 pounds. Until recently, these goats were kept to clear brush, but increased demand for goat meat and expanded interest in cashmere production has focused attention on the Spanish breed.

Nubian: Originally imported from Africa, the Nubian was developed by crossing British goats with Indian or African bucks. This is an all purpose breed, useful for meat, milk and hide production. Although not the heaviest milkers, the does do have higher than average butterfat content (4-5 percent). The udder of the Anglo-Nubian is capacious but is sometimes more pendulous than that of the Swiss breeds. In addition, the Nubian has an extended breeding season making it possible to milk the doe year round. Mature bucks should weigh at least 175 pound and does should weigh 135 pounds.

Myotonic: The Myotonic goats are often referred to as the Tennessee 'fainting' goats, 'wooden leg' or 'stiff leg'. The stiff-leg name is derived from the fact that, in a startled or frightened state, the goats 'lock up' and fall over and lie very stiff (faint) for a few seconds (a condition referred to as myotonia). Researchers claim that this type of involuntary muscle contraction could build a more tender muscle than a muscle developed by strenuous use. This is one of the few goat breeds indigenous to the United States. The Myotonic is a non-seasonal breeder, with the capability to produce three kiddings every two years. This breed is an excellent crossbred stock for the Boer goat, and because the 'fainting' trait comes from a recessive gene, the trait is not expressed in crossbred animals. The does are easy kidders, good mothers and good milk producers. Overall the breed is very muscular and meaty.

Pygmy: This breed is a dwarfed, heavily muscled and short-legged breed originating in West Africa. It is well suited to humid conditions, breeding is aseasonal and twinning is frequent.

Dairy Goats

The following breeds are used primarily for milk. Most of the common dairy breeds are temperate in origin and are seasonally polyestrous. However, they can be effectively induced to breed year-round (Walkden-Brown and Restall, 1997).

Alpine: The French Alpine dairy goat originated in the Alps and has been selected for uniformity, size and milk production. Mature females should weigh not less than 135 pounds and males should weigh not less than 170 pounds. French-Alpine females are excellent milkers and usually have large, well-shaped udders with well-placed teats of desirable shape.

LaMancha: The LaMancha goat originated in Oregon USA from short-eared goats of a type found throughout Spain. It has excellent dairy temperament and can produce despite less than favorable conditions. This breed has established itself in milk production with high butterfat.

Saanen: The Saanen dairy goat originated in Switzerland, and is medium to large in size (weighing approximately 145 pounds) with plenty of vigor. Saanen does are heavy milk producers and usually yield 3-4 percent milk fat.

Toggenburg: The Toggenburg is a Swiss dairy goat, known as the oldest dairy goat breed. This breed is medium size, sturdy, vigorous, and alert in appearance. They are slightly smaller than the other Alpine breeds, with the does weighing at least 120 pounds. Toggenburgs perform best in cooler conditions. They are noted for their excellent udder development and high milk production, and have an average butterfat milk content of 3.7 percent.

Nutrition and Grazing

Several options exist for goat production: pasture grazing, pasture grazing with supplementation, and confinement feeding with a view to increasing daily gains and shortening time on feed. In the US, currently, the majority of meat goats are reared extensively, that is, both the breeding herd and salable offspring are maintained and grown on forage and shrub-based diets with some supplement being fed occasionally. As a rule of thumb for single-specie grazing, 5 to 6 does and their kids will consume similar amounts of feed as one cow and her calf. Therefore, if the area available for grazing usually carries one cow-calf pair, five to six does and their kids can safely graze on the same area (Pinkerton et al., 1991; Hart, 2001).

Multi-species grazing, that is, the grazing of goats with another livestock species is also widely used. Most studies indicate greater production and better pasture utilization are achieved when cattle and goats are grazed together as opposed to grazing only goats or cattle alone (Pinkerton et al., 1991; Hart 2001). This is especially true where a diverse plant population exists. Because of the complementary grazing habits, the differential preferences and the wide variation in vegetation within most pastures, 1 to 2 goats could be grazed with every beef cow without adversely affecting the feed supply of the beef herd. The selective grazing habits of goats in combination with cattle would eventually produce pastures which would be more productive, of higher quality, and with few weed problems as a result of the mixed grazing. In grass-legume mixtures, cattle will generally graze the grass species more readily than sheep, which will prefer legumes and other broadleaf species (Nye and Moore, 2002).

Meat goats also can be reared under an intensive system. These enterprises are usually small (20-100 head), utilize small but productive land areas, use specialized feeding regimens to enhance growth rates, and generally have better profitability and production indices (conception, kidding and weaning rates, and average daily gains and weaning weights) (Pinkerton et al., 1991; Nye and Moore, 2002).

Growth Rate and Feed Conversion Efficiency

Goats generally have lower average growth rates and feed conversion efficiency than sheep (Table 4). Post-natal growth rates also vary widely between and within goat types, depending on genetic propensity, milk intake, supplemental feeding, incidence of disease, and environmental conditions. Based on the studies of Wheaton (1993) and Casey et al.

(1988), in well-managed flocks, the growth rates presented in Table 4 can be used as targets for grass/foraged based goat enterprises.

Table 4: Average Daily Gain(ADG, gm./day) and Weights (kg.) for Twin Reared Lambs and Goats

Age of Lambs/Goats	0-5 weeks		5-10 weeks		10-14 weeks	
	<i>Lambs</i>	<i>Goats</i>	<i>Lambs</i>	<i>Goats</i>	<i>Lambs</i>	<i>Goats</i>
ADG (gm./day)	136 (± 10)	62 (± 9)	275 (± 62)	139 (± 28)	260 (± 74)	182 (± 25)
Liveweight (kg.)	15	7	25.5	15	32	22.5

During the pre-weaning period, lambs can gain 300 gm./day (2.0 kg./week) while goats have achieved up to 227 gm./day from grass with some supplementation. Average feed conversion efficiency ranged from 8 to 10 kg./kg. for goats (Casey et al., 1988 and Wheaton, 1993).

Housing and Handling Facilities

Producers must consider the characteristics of goats when designing housing and handling facilities. Goats are generally curious and unpredictable, and exhibit “flocking” behavior. Their small size, agility and climbing nature, as well as the presence of domestic and wild predators, necessitate construction of effective housing and handling facilities (Penn State, 1994; Harwell and Pinkerton, 2000).

In spite of the management system chosen, goats require some shelter from inclement weather, especially during kidding, as young goats are vulnerable to respiratory infection, hypothermia and predation. Goats like to be in or near to a shed during the night hours, which also can play a part in predator control. A sturdy shed that is dry and opens to the south usually provides adequate protection. The structure should provide 8 to 10 square feet of floor space per goat, be closed on 3 sides, and be roofed low to the ground to trap body heat. Rear eave heights of 4 feet to 6 feet and front eave heights of 6 feet to 8 feet are adequate for housing purposes, if alternative areas are available for routine activities.

Goats may need occasional handling for de-worming, marking, foot trimming and sorting operations. Handling pens should be sturdy, preferably solid-sided and at least 4 feet tall. The working chute should extend from a crowding pen on one side of the main pen. Ideally, the working chute should be curved. It also needs to be solid-sided, about 10 feet long, 4 feet high, and 12 inches wide with sliding gates dividing it into sections. For horned goats, the chute should be tapered, with the top nearly twice as wide as the bottom. Canvas flaps suspended along the chute may keep the goats' heads down and prevent riding.

Feeders are a necessity for goats. Feeders need to be raised off the ground and constructed to keep goats out. Various designs are available, but feeders that hang on the side of the fence and are removed after goats are finished eating are especially effective. Some producers construct fence line feeders out of PVC pipe. Hay can be fed in bunks or racks or along a fence line. There should be enough feeder space for all the goats to eat at once; approximately 16 linear inches per doe and 12 linear inches for younger stock. A

clean supply of fresh water is a daily necessity and open tank drinking systems should allow 1 foot of space for each 15-25 head (for automatic watering systems, 1 bowl or nipple is generally sufficient for 50 head).

Fencing

The most common goat fence used is woven wire combined with barbed wire, also called 'wire net' (Figure 8). The wire mesh is usually 4 inches in height and topped by one or two strands of barbed wire, and may also have one strand at the bottom, just above ground level. Some manufacturers now produce a special "goat net" containing vertical stays ten or twelve inches apart, rather than the ordinary 6 or 8 inches. This usually helps a horned goat 'back out' through one of the rectangular openings much easier, and thus eliminate entrapment. Very young small kids can escape through these holes, but they will remain close to their mothers. Posts can be either wood or steel, and are set usually one rod (5.5 yards) apart, but is frequently closer when the area has abrupt changes in grade.

Barbed wire can be used in confining goats and is also predator-resistant. It is composed of 8 or more strands of 15.5 gauged barbed wire supported by wire stays every 4 to 5 feet to hold the wires in alignment (Figure 9). The wires are spaced 3 to 3.5 inches apart at the bottom and increased to 4, 5, and 6 inches between the wires towards the top of the fence. With barbed wire, posts can be placed up to 10 to 15 feet apart. With so many strands of barbed wire under tension careful attention must be given to having a stout set of braces to hold the tension of the wire. Although this may seem like an extensive undertaking, completed costs are usually less than for woven wire. An old cattle fence with corners and line posts that are already in place can be made 'goat-tight' using only four or more wires.

Electric fencing can be used effectively for goats (Figure 10). For perimeter fences, five or six alternating hot and ground wires is usually adequate and can be constructed for one third the cost of woven wire. A comparison of fencing construction costs is provided in Table 5. This comparison suggest serious consideration be given to the use of high tensile electric fences.



Figure 8: Woven wire combined with barbed wire (wire net)

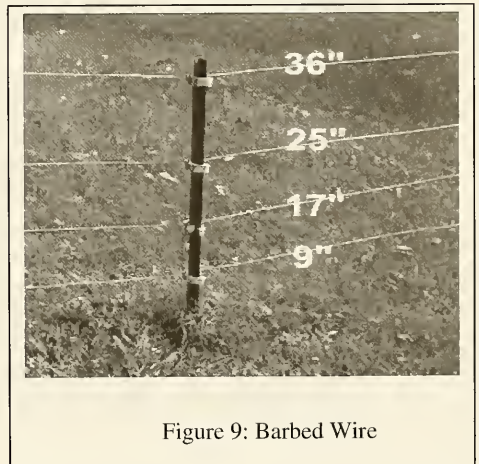


Figure 9: Barbed Wire

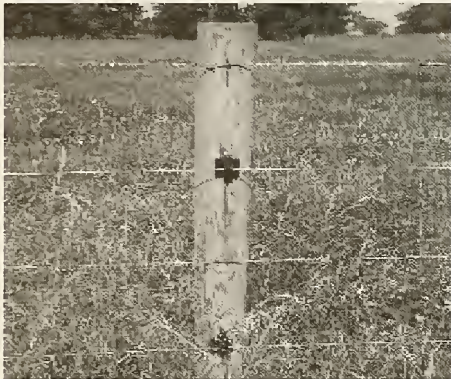


Figure 10: Electric Fencing

Table 5: A Comparison of Fencing Costs (\$ per linear foot)

Fence Type	Cost Per 100 Feet		Cost	
	Materials	Labor	Total	Per Mile
Woven wire plus 1 barb	\$70	\$27	\$95	\$5,016
Five strand barb	\$44	\$27	\$71	\$3,749
Three strand high-tensile electric	\$55	\$20	\$75	\$1,267
One wire portable electric	\$ 6	~	\$ 6	\$ 317

Source: University of Illinois Fence Budgets, Harwell and Pinkerton, 1991.

Goats are natural climbers, so all fence lines must be kept clear of rocks, stumps and fallen timber. Gates are also of importance to fencing; 'a fence is only as good as its gates'. All gates should be fitted with goat-proof latches, and should be as high as the fence itself without any gaps beneath the gate. Relative to width, also consider the need to drive equipment through the gate.

Predator Control

The most common predators of goats include coyotes, bobcats, and dogs. Barbed wire fencing is most effective for keeping goats in and predators out (Harwell et al., 2000). It can be made even more effective by running an electric trip-wire 8 inches high and 6 to 10 inches outside the fence. Predators may also be reduced by scheduling kidding to coincide with periods of limited predator activity (late fall to early winter). Other methods

for reducing predation include night penning, kidding in protected areas, and the use of guard animals such as dogs, llamas and donkeys.

Using Goats for Weed Control/Vegetation Management

The use of goats for controlling brushy and weedy species of vegetation has been documented, but remains underutilized in the US (Burgess et al., 2004; Hart, 2001; and Luginbuhl et al., 1996). This biological means of controlling weeds should command a greater role especially in the light of increasing environmental concerns and increased costs of mechanical and chemical control methods. For WV, this is even of greater concern because of the existence of large expanses of marginal lands, and lands with unsuitable topography for crops or even other livestock species, that can potentially be used as productive grazing areas.

Goats can help recycle plant nutrients sequestered in brush and weeds, thereby ensuring reestablishment of grassy species. Much of the hill land pasture in the Appalachian region of the United States and over 500,000 ha. of forest in the Southeastern region is infested with weeds, brush or kudzu (*Pueraria lobata*) (Hart, 2001; Luginbuhl et al, 1996). Luginbuhl et al (1996) reported that goats can effectively increase the proportion of favorable grass and legume species in the vegetative cover and reduce the presence of undesirable multiflora rose (*Rosa multiflora* Thunb), while achieving positive daily weight gains $79 (\pm 19)$ g/day and land area productivity $66.2 (\pm 12)$ kg/ha. Therefore, goat production represents a low cost, low input and environmentally acceptable management tool to convert these areas into productive land.

Pinkerton et al. (1991) suggested that goats can generate an equivalent of \$40-\$70 per breeding female per year in brush control and pasture improvement. The authors also noted that goat enterprises used primarily for brush control showed return to factors of production of \$40/doe compared to \$24/doe in enterprises involved in meat production solely when no monetary value was credited for pasture improvements. Effective brush control by goats requires the use of high stocking rates. However, use of high stocking rates may require some level of supplementation in order to prevent a reduction in kidding rates or kid weaning weights (Pinkerton et al., 1991). The resulting trade-off between pasture improvement and cash income from goat sales should always be considered fully in enterprise accounting procedures.

Apart from converting brush and weeds into a saleable product, goats can be grazed concurrently with cattle, making goat production suitable as an intermediate cash flow potential for beef producers in the state. Goats survive well on poor or fair grazing areas (with sufficient grazing material) without compromising biological efficiency, because goats usually are more proficient than other species at selecting the most nutritious parts of the plant (Gibson, 1995; Luginbuhl et al, 1996; Knights and Garcia, 1997; Hart, 2001).

Goats are "top down" grazers, prefer grass over clover, prefer browse over herbaceous plants, and typically graze along fence lines before moving to the center of the pasture. These grazing characteristics contribute to uniform grazing and effective weed control in areas browsed by goats. This advantage presents another way to increase income from goats, especially Spanish Goats. These goats are also known for their love of weeds, and may even pass over good hay for their favorite weeds. In Texas, goats are leased for

weed control at an average rate of \$4.00 per goat per month. It is possible that the cost of leasing goats for weed control will be greater in areas of the country where weeds are a major problem and goats are in short supply.

Breeding and Reproductive Management

Reproductive Behavior

Goats like sheep are seasonal short-day breeders, with maximum reproductive performance being associated with the shortening days of fall. The breeding season in the Northeast region is generally from August-January but does of some breeds can be bred year-round. Three key factors that influence the ability of goats to breed out-of-season are plane of nutrition, breed and body condition. During the breeding season goats show regular estrous cycles of 18-22 days in duration, but estrus is suppressed during pregnancy, post partum anestrus and the non-breeding season. Does are generally in estrus (heat) for 12-36 hours, with ovulation (release of the egg) occurring late in estrus (3-40 hours after onset). Common signs of estrus include tail wagging, receptivity to and actively seeking bucks, mounting and bleating. The ovulation rate (number of eggs shed at each ovulation) ranges from 1 to 2 but up to 3 ova can be released in some breeds or can be induced by manipulating, body condition and nutrition in the pre-breeding and breeding periods.

Body Condition Score (BCS)

BCS refers to the fleshing or fat cover of an animal. As noted earlier, the BCS of animal can affect the duration of the postpartum interval, the length of the breeding season and ovulation rate. Therefore consideration and manipulation of the BCS of the herd is an important management practice in goat production. BCS is estimated on a 1 to 9 point graduated scale, where 1-3 is thin, 4-6 is moderate and 7-9 is fat. Scores of 1-3 indicate an undernourishment problem, and scores of 8-9 are overly finished, which can predispose does to metabolic disorders during pregnancy. The ideal BCS prior to breeding ranges from 5 to 6 in order to maximize the kidding rate. See Table 6 (Herd Health Management Calendar) for BCS scores recommended for different phases of production.

Gestation

The mean gestation period in the doe is 149 to 150 days but can be about 2 days less with twin-bearing does. In the doe, unlike the ewe, there is a heavier reliance on the progesterone (the hormone of pregnancy) produced by the ovary compared to that produced by the placenta for maintaining pregnancy. There is evidence to suggest that this makes the doe more susceptible to stress-induced abortions, particularly around days 35 to 40 and days 90 to 115 (Walkden-Brown, 1997). Stressors such as malnutrition and transportation may induce abortions at any time.

Does generally deliver two kids with an average weight of four to six pounds each. Litter size and birth weight are dependent upon age and size of the does, breed of the does and sire, and feeding and care regimens³. Well managed herds may achieve an 80-95% kidding rate (number of does kidding), twinning rates of 60-80% and live kid crop of 120 - 175 %. Kid mortality is a major source of loss in goat production and may range widely

³ Birth weight increases with each kidding up to the fourth kidding.

during the first 6 months of life. According to Betancourt (1983), the major factors affecting the level of kid mortality include birth weight, dam's milk production, physical environment, nutrition level, predators, diseases, season and type of birth. Many extensive enterprises in the US achieve 1.25 – 1.50 kids weaned per doe exposed.

Puberty and Replacement for Breeding Flock

Length of herd life for does is variable, but 5 years is used for enterprise budgeting purposes. Also, a 20% per year breeding herd replacement rate is used and bucks are kept for 5-7 years depending on health and reproductive soundness.

Females can attain puberty as early as 4-6 months of age but are not usually bred until 8-9 months. The recommended breeding weight is 60-75% of estimated mature body weight. Males reach puberty at 4-8 months and can be bred from 8-10 months. Sperm production continues uninterrupted year round although most bucks show an increase in reproductive activity in late summer and fall in response to declining photoperiod. A ratio of 1 buck: 20 to 30 does is recommended, depending on pasture size and conditions. Producers often replace 20 to 25 percent of their breeding does each year. Doelings are often selected at weaning and should be chosen with emphasis placed on multiple births, high fertility, with an extended breeding season (early-born kids), birthing frequency, and pre-weaning growth rates. Replacement does should weigh at least 50 to 60 pounds before they are bred. If does are run year-round with the bucks, they often will breed at seven to nine months. If replacement females are bred at an early age a supplement should be provided to meet the animals' nutrient requirements for both growth and pregnancy. In general, replacement females that do not kid by two years of age should be culled from the breeding herd. Selection of bucks (or semen selection if artificial insemination is being used (Gacitua and Arav, 2005)) should emphasize growth rate and muscling, while reproductive traits should be emphasized in the does.

Methods to Induce Out-of-Season Estrus and Estrus Synchronization

Out-of-season (fall) kidding and estrus synchronization are important to the producer attempting to increase the profitability of his operation. With the traditional system of fall breeding, kidding in the spring a large supply of marketable kids are made available during the fall but supplies are limited during the spring and early summer months. This inconsistency in supply has many results: 1) variations in supply lead to wide price fluctuations and lower than average prices when supply is high; 2) interruption of the flow of kids into processing plants reduces forward planning or operating at optimum levels, both of which increase processing costs; and 3) irregular production and supply of kids means disruption in availability to consumers, which serves to dampen consumption. Engaging in out-of-season or accelerated breeding programs may help to address some of these concerns by evening out supplies throughout the year. Fall kidding may also be used specifically to reduce losses to predators and parasites because kids are weaned and sold early in the year, before levels of parasite and predator activities reach peaks. Timing breeding and estrus synchronization also allows for parturition at suitable times to take advantage of niche markets, feed supplies, labor, and rising price trends (Whitley and Jackson, 2004; Haibel, 1990; and Shelton et al., 1982).

A common approach used to induce does to breed out-of-season is the “Buck-effect”. It has been shown that when bucks that were previously separated from does are reintroduced into a common area, scent emitted by glands located behind the buck’s horns will induce estrus in does. This manipulation of social inputs (i.e. the buck) is called the “Buck” effect, and does will come into heat approximately 7 to 10 days after the reintroduction of the buck. This is a good strategy to naturally synchronize breeding does at the start of the breeding season or it can be used to induce does into heat out-of-season. Subsequent ovulations usually occur at the normal interval of approximately 21 days, depending on breed (Whitley et al., 2004; Haibel 1990).

Other approaches used to induce estrus in aseasonal breeds include the pre-treatment with progesterone or its analogue delivered by intravaginal sponges, controlled internal drug-releasing devices (CIDRs), or with feed (melengesterol acetate; MGA). The treatment period may vary between 5-18 days before introduction of the males and may also include an injection of gonadotropin at or before removal of progestogens and introduction of the male (Evans and Maxwell, 1987; Haibel 1990). Artificial lighting can also be used to induce out-of-season breeding by mimicking natural photoperiod-induced estrus. Controlling lighting requires confinement of females and can therefore be labor intensive and possibly costly (Walkden-Brown et al, 1997). Alternatively, treatment of bucks and does with melatonin (the hormone of darkness) which mimics the short-day photoperiod after exposure to natural long day photoperiod can be used to alleviate the need for controlled lighting and associated changes in confinement area. It must be remembered that, the type of treatment used and likely rate of success will depend greatly on the extent of breed susceptibility to photoperiod, time of year (depth of anestrus is greatest in late spring/early summer, and physiological state, BCS and nutritional status. Also, conception and pregnancy rates for these procedures tend to be lower than breeding at natural estrus.

Kidding Interval and Kidding to Conception Intervals

The interval between successive births is an important production variable, particularly for non-seasonal breeds of goat, and should be managed to maximize productivity during the life span of the does. An average kidding interval of 8 months with 3 kiddings in 2 years is achievable with some variation (Shelton and Lawson, 1982). The most variable component of the kidding interval is the period between parturition and the first post-partum estrus, referred to as *post-partum* or *lactational anestrus*. This period varies widely (40-170 days) and is influenced by breed, season, nutritional status, suckling stimulus, number of kids raised and parity of the doe (Walkden-Brown, 1997; Gibson 2000). Selecting animals with with long-breeding seasons and the use estrus-induction techniques can reduce the kidding interval and increase the life-time productivity of the doe.

Weaning

The traditional weaning age for most meat goat operations is 3 months. Some studies indicate that kids can be weaned successfully at 9 kg. of body weight, 8 weeks of age or at the time when at least 30 g/day of solid feed is being consumed. Weaning shock is

reduced when any of the above criteria are achieved. Restricted milk feeding encourages solid feed consumption by goat kids. In comparison with feeding milk three or four times per day, feeding milk twice daily reduces labor requirements, milk consumption, and growth rate, and increased efficiency of weight gain (Pinkerton et al., 1991). If solid feed intake can be stimulated, early weaning is possible as well as economical. Delayed weaning is costly and can be harmful to the development of a functional reticulo-rumen.

Nutrition, Health and General Management:

A Herd Management Plan for a Typical Goat Enterprise

Effective herd management programs can help the meat goat producer raise three kids per year from each doe to a market weight of 60 lbs. in less than six months. The management plan contained in Table 6 aims to increase the herd's productivity through improvements in general husbandry, nutritional management, parasite control, vaccination, and environmental management (Ahmed, et al., 1990; Shearer et al., 1994; Gipson, 1995; Schoenian, 2004 and Mobini, 2004).

General considerations for the typical goat enterprise are presented in Table 6. The practices may differ for individual enterprises depending on the specific conditions in the operating area. Consultation with a veterinarian is therefore recommended.

Additional Considerations

Other vaccines are available for use in goats for problems other than those mentioned here, including leptospirosis, chlamydiosis, sore mouth, bluetongue and footrot (Mobini, 2004; Shearer and Bliss, 1994). These vaccines should be used on veterinary recommendations to treat existing problems and used as a last resort after management changes have failed. It is important to consult a veterinarian who can prescribe appropriate medication given your specific farm situation. Also remember, because goats are sold for meat, adherence to appropriate withdrawal times (as per recommendation on label) and injections sites (in the neck region) are recommended so as not to compromise meat quality.

Internal parasites may be controlled in part by nonchemical means including reducing overcrowding, pasture rotation, fecal checks and deworming if necessary. Reducing parasite numbers via a "dose and move" strategy can help you to control parasites for the entire summer with only a few deworming; goats are dewormed, allowed to shed parasites and eggs and then moved to a new pasture, usually around early July and late August. Breed selection may contribute to parasite resistance: in a study of breed resistance to internal parasites, Gibson (1995) found Pygmy bucks to have the lowest fecal egg count and Nubians the highest.

A limited number of anthelmintic drugs are available for goats making drug resistance an issue of paramount concern. An Australian program designed to reduce the build-up of resistance to dewormers is especially appropriate in this context (Zajac, 2000). This program stresses the "CRACK" approach: Check for resistance; Reduce the frequency of exposure to dewormers; Annually rotate dewormers; Check the dose; and KeeP resistance off your farms.

The phosphorous content of forages is usually much lower than calcium content. The 1.5-2 calcium to 1 phosphorus ratio is important to maintain in mineral supplements to aid in the prevention of urinary calculi. Sodium and chlorine are commonly provided as free choice salt; goats not receiving enough of either may consume soil or debris. Placing salt in less frequently grazed areas can encourage them to move to these areas. Goats have a much higher tolerance to copper than sheep so typical cattle mineral mixes are usually safe for goats.

In grazing areas where plants are too low in protein content, additional protein must be provided in order to maintain acceptable goat performance. Protein supplementation takes many forms and varies in cost. Dividing the price of a cwt. of feed by its protein content will yield the cost per lb. of protein and thus facilitate comparisons. Feeding a hay of sufficient protein content may be optimal. Alternatively, a lb. of 20% crude protein cubes, or 0.5lbs. of 40% crude protein supplement, or 0.5-1.0 lbs. of whole cottonseed may be used. As an additional energy source, 0.5-1.0 lbs. of shelled corn or whole cottonseed can be used to compensate for low-quality hay. Although cost per unit of energy is high, without it, conception rates, milk flow, and kid growth rates are compromised and overall gross income is reduced.

Managing Breeding and Kidding Dates: *A Working Example of When to Kid and When to Wean* (adapted from Pinkerton et al, 1994 [B]).

Integrating the marketing and management considerations mentioned above can help the producer decide when to breed, kid and wean in order to pursue targeted markets. The following illustration provides a working example of a more controlled breeding sequence, which may be useful in order to exploit special market opportunities outside of the traditional periods; avoid mid-winter kidding; and/or better utilize seasonal forage supplies.

Illustration of calculations to meet a target market of Easter on April 14, 2006.

Make the following assumptions:

1. You will ship the kids on April 5th (7-14 days are typically required for processing and distribution).
2. You wish to ship male and female Boer X Spanish cross weighing an average of 60 lbs. live weight. Consulting Table 2 and other information given above, estimate that the kids will need 16-17 weeks to reach slaughter weight (weighing 7 lbs. at birth and growing an average of 0.5 lbs./day⁴).
3. Using an average 16 week post-natal growth period, the kids would need to be born on 12-22-05, plus or minus a week or so.
4. Given the gestation period of 149 days, the does would need to be bred 7-26-05, plus or minus a week or so.

⁴ For slower growing kids, you may want to assume 1/3 lb. of gain/day. This means an average of 22 weeks post-natal growth to get a 7 lb kid to 60 lbs market live weight. In this case, kids will have to be born on 11-22-05, plus or minus a week or so.

Table 6: Herd Health Management Plan for a Typical Goat Enterprise

PERIOD	GENERAL MANAGEMENT	FEEDING	HEALTH
Pre-Breeding to Breeding	- Trim feet - Check for external parasites and treat if necessary. - Deworm does and bucks 2-3 weeks prior to flushing and/or introduction of the bucks.	- Monitor Body Condition Score (BCS) and plan a nutritional flushing program does with <4 BCS, at least 3 weeks before breeding. - Sort does into groups by BCS and adjust nutrition to achieve a BCS of 5-6 on a scale of 1-9 for highest conception rates and kidding percentages. - Flush by feeding ½ pound cracked corn or whole cottonseed/head/day ("feed-flush") or switch does to high quality pasture ("green-flush") for 2-3 weeks. Weight gain is accompanied by increased fertility, conception and twinning. - Supplement nutrition of bucks - Goats typically consume between 3-5% of body weight in dry matter daily.	
Early Pregnancy (1-15 weeks Post Breeding)	Ultrasound scanning of does at around day 60 to separate multiple bearing does which may be economical to supplement or manage on better pasture.	Manage does on average quality hay or pasture- do not over-feed at this time.	
Pre-Kidding (4-6 Weeks before Kidding)	- Examine for external parasites and treat if needed. - Deworm 2 weeks before kidding. - Proper body condition must be maintained to prevent metabolic problems post-kidding.	Supplemental selenium should be provided either in the feed/mineral mix or by injection of 5 mg selenium (BoSe or MuSe). This is especially important in selenium-deficient pastures to reduce the rate of retained placentas⁵.	A five-way Clostridium vaccine (C. perfringens types C and D; C. nolyse; C. chauvoei; C. septicum; and C. sordelli) for bucks and does along with a tetanus booster for does three weeks before kidding to ensure good transfer of maternal immunity to kids.

⁵ Selenium has a very narrow margin of safety. Goats require 0.2 parts per million of selenium, and the toxic level is 3 ppm. When using MuSe, the dosage needs to be highly diluted for kids. Some symptoms of selenium deficiency are identical to those of selenium toxicity. It is prudent to check with the vet before using supplemental selenium (Ahmed, Adam, Idrill and Wahbi, 1990; Schoenian, 2004).

Table 6: Herd Health Management Plan for a Typical Goat Enterprise (continued)

Kidding	▪ Confine does in a clean maternity pen. ▪ Wash the does udder and soiled hindquarters. ▪ Dip navel of newborn in 7% tincture of iodine. ▪ Kids should nurse within 1 hour of birth and consume 10% of their liveweight in colostrums during 12-24 hours after birth. ▪ Remove placenta and discharges.	▪ If you supplement with a concentrate or hay, feed it at nights as late feeding delays birthing toward the early morning hours in the majority of animals.	▪ In herds affected with Caprine Arthritis Encephalitis (CAE), separate kids from mothers and feed with 2-3 ounces pasteurized goat colostrums or cow colostrums.
Post-Kidding and Pre-Weaning	▪ Debud at 7-10 days and castrate male kids at this time.	▪ For selenium-deficient areas, feed supplementation or selenium injections are recommended for prevention of White Muscle Disease (WMD). Current recommendations are an initial injection of 1 mg selenium (BoSe) at one week of age and again at weaning.	▪ Kids receive the Clostridium vaccine at 1-3 weeks of age and receive a booster 2 weeks later. ▪ Deworm kids at 3-4 weeks and again at 3 months.
Weaning	▪ Wean kids by 3 months. ▪ Trim feet before pasturing kids.	▪ Ensure sufficient Thiamine content to prevent Polioencephalomalacia.	▪

As is readily apparent, targeting a specific marketing date is an inexact science to say the least. A closer look at the calendar in Table 2 can indicate better timing to provide a somewhat wider window of opportunity for target markets.

The positive response for better conditioned goats in the Texas market was seen in Figure 4. The increased revenue potential of improving condition and possibly larger selling weights may be beneficial in this market. Some producers aiming for similar markets, especially the restaurant markets in the northeast, may elect to 'hold' goats to capitalize on higher prices and also increase selling weight and body condition. Consider however, that the added cost associated with delayed marketing could exceed the added income realized from selling larger goats at higher prices. One must consider the market in which you are operating, and the specific product preferences of the target market, and the price difference for weight-specific carcasses. In the Northeast, different ethnic groups pay premium prices for different carcass specifications relative to weights, finish and age.

Meat Goat Enterprise Analysis

The following section is intended as a guideline in the estimation of the production costs and returns for WV meat goat operations and an aid to producers in selecting enterprise combinations. Budgeting is the basic analytical tool that producers use in making production decisions and it is the foundation of a reliable management program. It is important to remember that these projections will not be the same for all producers due to differences in animals, management levels, soils, feeding strategy, weather, prices received, prices paid, and operational practices.

Following the budget, sensitivity analysis is included to emphasize how changes (to your enterprise budget) in specific production, management and marketing variables can change the bottom line for your operation.

Assumptions

Does	30	No. of Kids Born	51
Buck	1	Kid Mortality Rate	10%
Conception Rate	95%	No. of Kids Weaned	46
Kidding Rate	180%	Kids Sold for Meat	41
Doe Mortality Rate	5%	Kids Kept as Replacements	6
Doe Cull Rate	20%	Replacement Buck	1 every 2 yrs.

Production and Marketing System

This analysis is based on a meat goat herd in West Virginia, comprised of 30 does and one buck. The herd is assumed to be raised on a five-acre forage pasture with a barn that serves as housing (20 sq. ft./doe unit in barn and 30 sq. ft./doe unit in lot). No other housing is assumed. A five strand high-tensile electric fence is assumed.

This operation assumes that does are bred in the fall and kid in the spring to capitalize on pasture availability, with production statistics as stated above. The goat herd grazes on the five-acre pasture throughout the year (215 days), except in the winter months. Does are fed 4 lbs. of hay for 200 days, 1 lb. of grain for 90 days during winter for lactating does and 0.5 lbs. of grain for 150 days for dry does during the winter. Does are also fed 1

lb. of grain 30 days prior to and 60 days after kidding. Kids are fed 0.5 lbs. of grain for 160 days. Kids sold at 5-6 months of age at 65 lbs. live weight at an average price of \$1.15/lb. Other sources of receipts include stud services and some value for pasture maintenance or improvement. Salt and mineral blocks are provided throughout the year, and pasture management and parasite control are implemented as described in the herd health management program.

Does are culled at a rate of 20% per year and replacement does are assumed to be “purchased” from the pool of market kids at \$70.00/head. The rest of the kids, as well as culled does, are sold for meat. Culled does bring an average of \$0.75/lb. The buck is replaced every 2 years, with the culled buck sold for breeding or meat at the local livestock auction, at a projected value of \$90.00. Market goats are transported to the local livestock auction at a cost of \$6.00/head and incur marketing costs (yardage and commission) of \$4.00/head.

Enterprise Budget

A budget summarizing the costs and returns for a 30 doe/1 buck meat goat operation in West Virginia is presented next (Estimated Costs and Returns for a Meat Goat Enterprise in WV). It represents common, workable combinations of inputs that can achieve a given output. The specific combinations of inputs and prices presented may not reflect any given farm and in practice, actual costs may be higher or lower than shown depending on the specifics of your operation. The enterprise budget shown should be used as an example of how to assemble your own combination of inputs for your existing/prospective operation and assess your own costs and returns. The column on the enterprise budget labeled ‘your farm’ is provided for this purpose.

Estimated Costs and Returns for Meat Goat Enterprise in West Virginia

Meat Goat Operation

No. of Does	30	No. of Cull Stock Sold	5	Average Price/Lb. Received (Kids)
No. of Bucks	1	Lbs. of Concentrate/lactating doe/day	1	Average Price/Lb. Received (Cull Does)
Conception Rate	95%	No. of Days on Concentrate	90	Price/Hd. For Replacement Does
Kidding Rate	180%	Lbs. of Concentrate/dry doe/day	0.5	Price/Hd./Year For Cullled Buck
Doe Cull Rate	20%	No. of Days on Concentrate	150	Concentrate (\$/cwt)
Doe Mortality Rate	5%	Lbs. of Hay/doe/day	4	Forage Acreage
Kid Mortality Rate	10%	No. of Days on Hay	200	No. of Days on Pasture
Kid Mortality Rate	5%	Lbs. of Concentrate for Kids	0.5	
No. of Kids Born	51	No. of Days on Concentrate	160	
No. of Kids Sold	41			
Replacement Does	6			

Gross Receipts

Unit (Lbs./Hd.)	Quantity	Price or Cost /Unit	Total/Herd	Total/Doe	Your Farm
Market Goats Sold	65	\$0	\$0.00	\$0.00	
Replacement Does	6	\$0	\$0.00	\$0.00	
Cullled Does	120	\$0	\$0.00	\$0.00	
Cullled Buck	160	\$0	\$0.00	\$0.00	
Other (Stud Services & Pasture Maint.)	0.5		\$800	\$26.67	
			\$800.00	\$26.67	

Gross Receipts

Variable Costs

Unit	Quantity	Price or Cost /Unit	Total/Herd	Total/Doe
Concentrate (Lactating Doe)	90	\$0.11	\$282.15	\$9.41
Concentrate (Dry Doe)	75	\$0.11	\$247.50	\$8.25
Concentrate (Kids)	80	\$0.11	\$448.80	\$14.96
Hay (Does)	800	\$0.03	\$720.00	\$24.00
Vet. & Med.			\$0.00	\$0.00
Deworming Does (X4)	4	\$0.75	\$90.00	\$3.00
Deworming Kids (X4)	4	\$0.35	\$71.40	\$2.38
Vaccinations (Does)	2	\$1.00	\$60.00	\$2.00
Salt and Minerals	3	\$10.00	\$30.00	\$1.00
Marketing	46	\$4.00	\$184.00	\$6.13
Trucking	46	\$6.00	\$276.00	\$9.20
Supplies	30	\$2	\$60.00	\$2.00
Labor	203.5	\$5.00	\$1,017.50	\$33.92
			\$3,487.35	\$116.25
			(\$2,687.35)	(\$89.58)

Total Variable Costs
Returns Above Variable Costs

Fixed Costs	Cost	Years Life	Interest & Repairs (%)	Total/Doe
Livestock Costs				
Doe Cost	\$70	5	0.05	\$17.50
Buck Cost	\$300	2	0.05	\$5.50
Housing	\$	20	0.25	\$0.00
Fencing	\$ 605.00	20	0.25	\$6.05
Equipment	\$ 150.00	10	0.25	\$1.75

Total Fixed Costs

\$924.00	\$30.80
(\$3,611.35)	(\$120.38)

Returns to Land, Labor and Management

Sensitivity Analysis

This section provides an illustration of how changes in 'profitability drivers' contained in your enterprise budget (doe cost, kidding rate, weaning rates, production costs and prices received) can alter the bottom line (profitability) of your operation.

The relationship between reproductive performance and the break-even price required to cover production costs is illustrated in Table 7.

Table 7: Relationship between Cost of Production and Reproductive Performance

Doe Cost \$/hd/yr	Kid Crop Weaned						
	70%	80%	90%	100%	125%	150%	200%
	Breakeven Price, \$/lb.*						
45	1.07	0.93	0.83	0.75	0.60	0.50	0.38
50	1.19	1.04	0.93	0.83	0.67	0.56	0.42
60	1.43	1.25	1.11	1.00	0.80	0.67	0.50
70	1.67	1.46	1.30	1.17	0.93	0.78	0.58
80	1.90	1.67	1.48	1.33	1.07	0.89	0.67
90	2.14	1.88	1.67	1.50	1.20	1.00	0.75
100	2.38	2.08	1.85	1.67	1.33	1.11	0.83
110	2.62	2.29	2.04	1.83	1.47	1.22	0.92
120	2.86	2.50	2.22	2.00	1.60	1.33	1.00
130	3.10	2.71	2.41	2.17	1.73	1.44	1.08
140	3.33	2.92	2.59	2.33	1.87	1.56	1.17
150	3.57	3.13	2.78	2.50	2.00	1.67	1.25
160	3.81	3.33	2.96	2.67	2.13	1.78	1.33
* Assumed market weight: 60 lbs. Does bred to kid once per year							

These calculations use percent 'kid crop' as a realistic measure of reproductive performance. The percent 'kid crop' is calculated as:

$$\% \text{ kid crop} = \# \text{ kids weaned} / \# \text{ does exposed}.$$

Generally, a positive return above total costs (fixed and variable costs associated with production and marketing) is necessary for an enterprise to be profitable in the long run. As an example, given a doe cost of \$80/doe/year and a weaning rate of 150% (1.5 kids weaned/doe exposed), implies the producer will have to recover \$53.33/kid/year (\$80/1.5) before a profit can be made.

Given a market weight of 60 lbs. the breakeven price (price at which all costs are covered but profits and losses are zero) can be calculated as follows:

$$\begin{aligned}\text{Breakeven Price} &= \text{Doe cost} / \text{lbs. of meat marketed} \\ &= (\$80) / [\text{market weight (60lbs.)} \times \text{weaning rate (1.5)}] \\ &= \$0.89/\text{lb. of meat marketed}\end{aligned}$$

Therefore, the producer will need to receive \$0.89/lb. of meat marketed per doe in order to fully cover all costs. As the breakeven price suggests, above \$0.89, the producer will start making a profit, and under \$0.89, losses will be incurred. Analyzing the breakeven price for varying doe costs and percent kid crop, as shown in Table 7, underscores the interaction of multiple factors in determining profitability. The price necessary to 'breakeven' will be reduced as doe costs are reduced or kid crop is increased. Alternatively, breakeven cost rises as doe costs increase or kid crop is reduced.

The relationship between kidding rate and returns to land, labor and management per kid marketed is shown in Table 8. A sensitivity analysis of budgeted returns for the enterprise budget given previously indicates that a kidding rate of approximately 140% (1.4 kids/doe) is required for the 30 does:1 buck goat enterprise to break-even, all other factors remaining the same (*including revenue from other sources as shown in the enterprise budget; average market weight of 65 lbs./kid; and average market price of \$1.15/lb.*). Assuming doe costs and market price remain the same as in the enterprise budget, lower kidding rates will mean negative return to land, labor and management (i.e. losses), while higher kidding rates will improve your bottom line (i.e. profits).

Table 8: Sensitivity of Returns to Land, Labor and Management to Kidding Rate

Kidding Rate	Returns to Land, Labor and Management/Kid Marketed
120%	-\$12.46
130%	-\$5.00
140%	\$2.49
150%	\$10.00
160%	\$17.44

Table 9 shows the relationship between prices received and returns to land, labor and management. Assume other revenue conditions in the enterprise budget hold, that is, revenue from replacements animals, culls and other services total \$57.13/doe. As illustrated in Table 9, a 10% decline in the prices received as shown in the enterprise budget will result in negative returns to factors of production, assuming all other factors remain constant.

Table 9: Sensitivity of Returns to Land, Labor and Management to Prices Received by Farmers (Assuming current market price is \$1.15/lb.).

Pries Received (% of Prices in assumption)	Returns to Land, Labor and Management/Doe
90% (\$1.04)	-\$26.88
100% (\$1.15)	\$8.08
110% (\$1.27)	\$112.80

The relationship between production costs and returns to land, labor and management is shown in Table 10. A slight increase in cost of production of 10% or more could mean negative returns to factors of production, under current prices and kidding rates.

Table 10: Sensitivity of Returns to Land, Labor and Management to Total Cost of Production by Farmers (Assuming current total cost/doe is \$151.25).

Production Costs (% of Production Costs in assumption)	Returns to Land, Labor and Management
90% (\$136.13)	\$23.33
100% (\$151.25)	\$8.08
110% (\$166.34)	-\$7.01

Other Factors Affecting Profitability

As we saw from the previous sections, market weight, kidding crop, production cost/doe and selling price are all important (and interrelated) factors influencing the profitability of the goat operation.

As a related concept, the percentage of kids marketed per doe per year has a tremendous impact on the profitability of the goat operation. Conception rate, kidding rate, kidding percentages (kids born/doe lambing), kid mortality, and the number of kids weaned all affect the kid crop marketed. Planning and preparing for the breeding season, as outlined in the herd management calendar in Table 6, is the first step in ensuring a great kid crop and in reducing the costs associated with winter feeding of non-productive does.

In the longer run, producers might consider increasing the size of their breeding flock. Operating with breeding doe flock sizes of fewer than 50 head implies that producers may have too small a size of operation or volume of production to be economically efficient. A larger scale of operation can increase profitability by reducing operating and marketing costs per doe because fixed costs are spread over more production units; or by having a larger, more uniform lot of kids to market, so as to potentially avoid discounts for smaller, non-uniform lots.

Genetic diversity results in a lack of uniformity and consistency in product offerings, which makes it difficult to attract buyers to Northeast auctions or to pool kids. Improvements in the genetic base of the breeding herd over time, can help operators to produce more uniform lots, as well as to better match their product offerings with consumer specifications.

Producers need to be aware that the efficient use of labor, especially at kidding time, affects their profit potential. The goat herd is labor intensive at kidding time and most deaths occur within the first three days of life. Estrous synchronization can be used to consolidate labor at breeding and at kidding and potentially reduce mortality.

As seen above, managing the production costs can improve your profitability. Production decisions, including timing of breeding and lambing, size of the breeding flock, labor efficiency, feeding regime, health management and predator control all work together to determine how many, what types of, and at what costs, kids are produced.

After production decisions are made and selling time comes, you must decide where the best market exists. The selling weights, sale period, market price, and marketing strategy all work together to influence the producer's bottom line and allow the best return from the market. This is covered in the following sections.

Marketing Channels for Meat Goat Sales

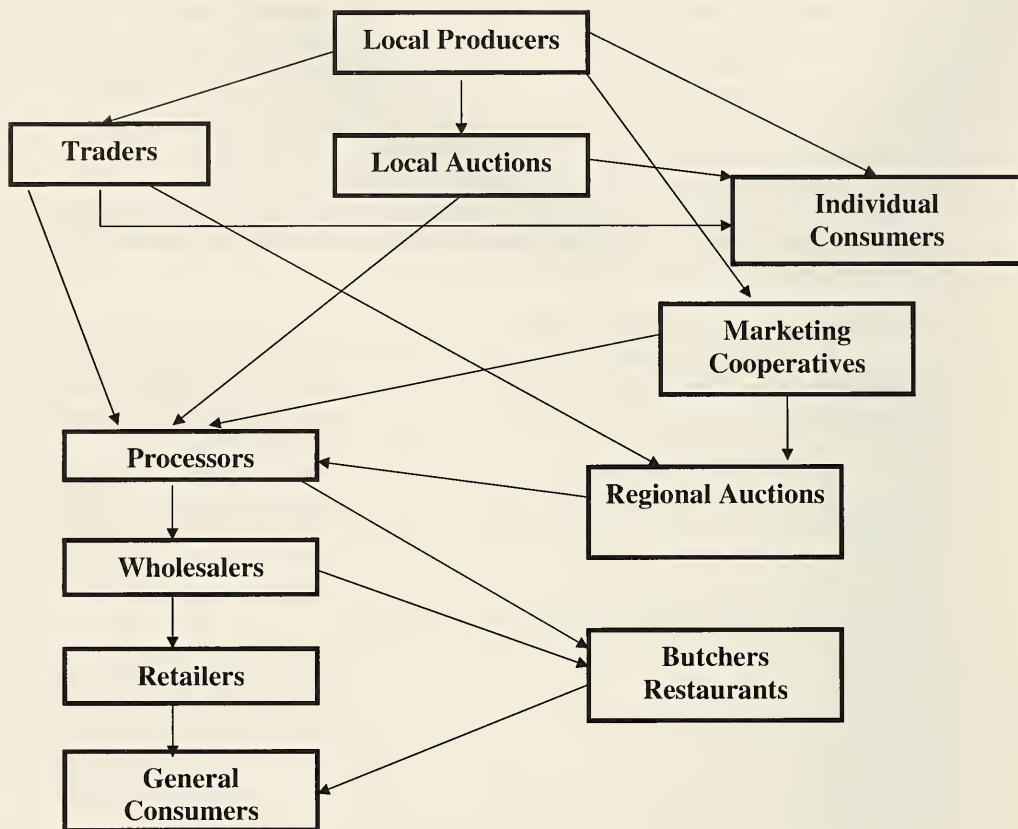
Several marketing inefficiencies currently plague the goat industry, and can adversely affect prices and producers' options. Marketing is rather haphazard, with substantial variations in animal availability, uniformity among sale lots in terms of weight and carcass characteristics, processing techniques and market distribution.

Figure 11 shows the current marketing channels for meat goats in the US, which range from simple direct transactions between producer and consumer to more complex channels involving up to four intermediaries. The latter forms appreciably increase the cost-spread between primary producers and final consumers. Organizing and simplifying these marketing channels can reduce the margin between farm-gate and retail prices, thereby increasing farm-gate prices and lowering retail prices.

Additionally, producers who recognize and utilize the widest set of alternative marketing methods have the best chance of improving the profitability of their goat enterprise. Several alternative marketing strategies that producers might consider include goat pools, special graded goat sales, tele-auctions, electronic marketing, forward contracting, and direct marketing. An effective marketing method might provide more market power and control to the producer and consequently play a key role in determining the overall profitability of the goat operation.

For example, pooling animals means that transportation and marketing costs are spread over more animals, and price premiums can be obtained for larger (and possibly more uniform) lots. Direct marketing, niche marketing or forward contracting to specific target markets all imply more market power, because products are better matched to consumers' demands. Collectively, these marketing methods allow producers to be price makers rather than price takers. Further, these marketing methods can be manipulated to address the unique considerations of the individual small producer.

Figure 11: Existing Channels for Meat Goat Sales



Source: Pinkerton et al, 1994[A]

Marketing Plan for Northeast Goat Producers

The goat producer should engage in ‘marketing’, rather than simply ‘selling’, his/her kids. This involves deliberate decisions concerning how he/she produces, prices, promotes and sells kids. Higher profitability can be achieved by carefully coordinating several issues, including what type of kids are produced, and when, where and how these kids are sold, among others issues. The goat producer can organize these activities into a ‘Six-Step Marketing Plan’, which summarizes the key marketing decisions encountered earlier, including what to produce, when to sell, how to sell and where to sell.

A Six-Step Marketing Plan for Northeast Goat Producers (adapted from Alberta Agriculture, Food and Rural Development: An Introduction to Livestock Marketing)

- 1) Specify Marketing Approach: Recognizing how you feel about marketing is essential to developing an effective marketing plan. Some producers may adopt a defensive approach to marketing – carefully protecting against price risk and market volatility. Others may adopt an offensive approach – exploring different market alternatives to seek out the most profitable avenues. Yet others might consider a pragmatic approach - trading off between convenience and revenue. The producer must recognize that these approaches require different levels of risk tolerance; risk averse, risk loving and risk neutral, respectively, as well as different levels of time commitment. It is up to the producer to determine his time flexibility, his ability to tolerate financial risk, as well as his psychological attitude towards taking risk, and select an appropriate marketing approach.
- 2) Estimate Costs: The next step involves estimating production costs and cash flow needs. This information can help the producer decide what type of animal to produce and when it will have to be sold to meet payment schedules. This step involves looking at price forecasts to determine the best time to sell and also how kids would be marketed. Breakeven estimates and scenario analysis should be used to set a series of target prices that should be watched for in the market. Such information also can be used to determine when to expand or reduce the size of a breeding herd.
- 3) Gather Information, Including Market Outlook: Keeping abreast of market trends and price forecasts can help the producer decide what to produce (finished weight, carcass quality), when to kid so as to capture a specific target market, and what marketing method to use in order to secure highest returns.
- 4) Know Your Product: It is said throughout the marketing world that “*you do not get what you deserve, you get what you negotiate*”. Knowing the quality and type of kids available for sale can aid the producer in seriously evaluating different pricing strategies and marketing methods. By knowing what you have for sale, you can choose to forward contract them to a targeted market, or directly

contact buyers or consumers and negotiate prices and terms of sale. In this way, the producer will move from simply 'marketing what they produce' to actually 'producing for a market', the latter being potentially more profitable.

- 5) Set Several Target Prices: In order to set target prices, the producer must have four key pieces of information: cost of production, cash flow needs, breakeven prices, and what the market is paying or is expected to pay. Cost of production and breakeven prices provide the producer with the minimum acceptable prices. Cash flow needs indicate when kids should be sold to meet financial obligations. By examining market outlook, the producer can plan to sell kids in order to hit a target market price. Market outlook can help establish a price range, between optimistic and pessimistic prices, within which producers think prices will occur with a high probability. This forces the producer to consider market volatility in determining target prices.
- 6) Evaluate Pricing and Marketing Alternatives: Producer should evaluate all possible pricing and marketing alternatives when selling kids in order to bring the greatest returns. Each alternative has specific advantages or disadvantages that make it suitable/unsuitable under different conditions. Bear in mind that the negotiated price, terms of sale, and delivery method all determine the final returns to the producer (consider that delivery involves transportation costs, shrink costs and in some cases, yardage fees or commissions). Again, by knowing the product, and knowing production costs, cash flow needs, breakeven prices and market outlook, the producer can seek out the best markets and negotiate the best terms of sale.

Summary- Improving the Industry

Goat production presents a viable economic opportunity for West Virginia producers; WV is within proximity to major goat consumption areas; goats can thrive well on marginal lands and forages, which are abundant in WV; goats have been proven effective as biological weed controls and pasture rehabilitation; and the fact that resources can easily be converted from other enterprises to a growing goat industry.

The supply of slaughter goats is seasonally skewed resulting from seasonal breeding and kidding, and the usual shortage of forage during the fall and winter months. The seasonal supply of goats during June through November is mismatched with consumer demand, which is generally highest from December through April. This recurring imbalance in supply has resulted in low prices for producers selling kids when supplies are the highest and substantially higher prices for consumers during the winter and spring (traditional holidays). This interruption in supply encourages some distributors to market imported products exclusively and reduces the visibility of goat meat year round.

Relatively high marketing costs, competition from traditional red meats, erratic carcass quality, commercial trade resistance, and uninformed consumer attitudes toward goat meat are other factors limiting growth in the goat industry. The events of September

11th, 2001, have resulted in many ethnic consumers maintaining a low profile, or becoming reticent in approaching/seeking out products.

The foregoing analysis shows that meat goat production can be a viable economic option for WV producers. However, the realization of adequate economic benefits is contingent upon implementation of a conscientious management program in both production and marketing to overcome the inefficiencies in the industry. Producers need to develop innovative ways to contact and serve identified consumer groups with the desired domestic product offerings in sufficient quantities year round. Based on the foregoing analysis, recommendations to achieve this goal include:

- Increasing production areas closer to meat goat consumers (east coast ethnic markets for WV and surrounding producers) could reduce consumer costs and increase demand, and so improve the industry over time.
- There is need to develop a system of uniformity of management among goat producers that promotes accelerated breeding cycles and staggered kidding (in-season and out-of-season breeding) to provide goat products more reliably year round and to meet market-specific age/weight demands.
- Out-of-season kidding also can help reduce losses due to parasite infestation and predation by timing kidding to avoid periods of high parasite and predator activity.
- Increased use of nutritional management (flushing procedures) and the reproductive management (including use of the 'buck effect') to increase ovulation/conception rates and to synchronize/group kidding dates can help improve labor utilization, weaning rates and market returns.
- Selective marketing strategies can allow producers to be price makers rather than price takers; being better able to negotiate prices and terms of sale based upon delivering the desired product to the appropriate target market. Contact and communication with target markets and getting educated about the market and consumer preferences are recommended.
- Web-based regional marketing services (on-line centralized directory and possibly a trading system) can facilitate and improve communication among marketing channel participants for the purpose of matching quality and quantity of goats demanded and periods of demand with goat supply, and in determining how to get those goats to buyers in the most profitable way.
- Selling cuts directly to retailer or restaurants leaves the question of what to do with the rest of the carcass. Many ethnic restaurants have recipes that utilize the entire carcass and there is merit in seeking out these potentially viable markets. Additionally, the value-added/processed segments of the goat market offer significant potential for expansion.
- There is a strong trend in the US for the consumption of farm fresh goat products. There should be a focus on ensuring that consumers can easily acquire the product they need by ensuring a year round supply and attention to specific preferences, but also that ethnic consumers are made to feel welcome

when seeking out product through established channels, and that the marketing system allows sufficient marketing choices.

- Understanding and controlling other key factors, such as production costs, herd size, genetics, reproductive indices and prices received, can improve the profitability of the meat goat enterprise.
- Each producer should be encouraged to develop a formal marketing plan to support the strategy they have selected for their individual enterprise. Such plans are important to target specific markets, to prevent reaction to problems in a piecemeal manner and to help in anticipating problems or opportunities.

CONCLUSION

Goat production can help revive some small family farms in the Appalachian region. This requires the interaction of production and marketing objectives and commensurate changes in production and marketing strategies to help producers overcome some of the challenges plaguing the goat industry. Efficiency and profitability improvements in the WV goat industry hinge on producer's willingness to change as well as on industry participants willingness to support such changes.

This study provides an overview of the current goat production and marketing environments in the US, with a view to improving the profitability of small farms in WV through increased goat production. This information can be used by individual producers or extension educators to develop and evaluate different production and marketing options and opportunities in addressing current problems and impediments in the industry. Such information can be used for the development of effective marketing strategies and outreach and education programs tailored to meet the needs of goat producers and the expectations of consumers as the goat industry grows and matures. This undertaking will strengthen marketing linkages by improving overall management practices and coordinating improvements between goat producers, between producers and buyers, and between producers and specialty or niche end-market consumers. Adoption of improved marketing strategies can help enhance the profitability of small independent goat producers in West Virginia. In general, for the future of the WV goat industry, such efforts can help improve the overall goat inventory, the potential for stabilizing markets, becoming more market driven, and increasing and promoting economic stability and economic growth in the region.

Bibliography:

1. Addrizzo, J. (2000) Meat Goat Production Handbook: Use of Goat Milk and Goat Meat as Therapeutic Aids in Cardiovascular Diseases. Clemson State University. <http://www.clemson.edu/agronomy/goats/handbook/>
2. Ahmed KE, Adam SE, Idrill OF, Wahbi AA. (1990). Experimental selenium poisoning in Nubian goats. *Vet Hum Toxicol.* 1990 Jun;32(3):249-51.
3. Alford, C., Strickland, J., Lewis, K., and Simpson, S. (1998). Meat Goat Production in Georgia. Cooperative Extension Service, The University of Georgia, College of Agricultural and Environmental Economics, Athens Georgia. Bulletin 1168.
4. B'NAI BRITH (1999) "The Jewish Holidays." [Http://banai.brith.org/caln.html](http://banai.brith.org/caln.html) (September, 2004).
5. Betancourt, O.J.G. (1983) Genetic Analysis if a Crossbreeding Experiment Using Improved Dairy Goat Breeds and Native Goats in a Dry Tropical Environment. Ph.D Thesis, University of Southern California, Davis 186 pp.
6. Burgess, M.R., Barker, D.J., Zartman, D.L., Sulc, R.M., and Harrison, S.K. (2004). Forage Species and Spatial Effects on the Dietary Intake of Goats. *Hay and Pasture Update* Sept/Oct 2004 volume 2, issue 5. University of Maryland, College of Agriculture and Natural Resources.
7. Casey, N.H., and Van Niekerk W. A. (1988). The Boer Goat II. Growth, nutrient requirements, carcass and meat quality. *Small Ruminant Res.*, 1:355-368.
8. Essel, A.E. (2000). Meat Goat Enterprise Analysis. Goat Notes: Meat Goat Expo Proceedings, Virginia State University, Petersburg, VA.
9. Evans, G. and Maxwell, W.M.C. (1987). *Salamon's artificial insemination of sheep and goats*, 1st edn. Butterowrths, Sydney, Pp 194.
10. Gacitus H, and Arav, A. (2005). Successful pregnancies with directional freezing of large volume buck semes. *Theriology.* 2005 Feb; 63(3):931-8.
11. Gipson T. A. (1995) Research Update: Breeding and Genetics "Are some goats (breeds) more resistant to internal parasites than others?" Goat Notes: Meat Goat Expo Proceedings, Virginia State University, 2000.
12. Gipson, Terry A. (2000). Meat Goat Breeds and Breeding Plans. In: Meat Goat Production and Marketing Handbook, North Carolina. p. 12-18.

13. Gibson, T. A. (2002). Demand for Goat Meat: Implications for the Future of the Industry. Langston University Goat Research Extension Publication. http://www2.luresext.edu/goats/library/field/goat_meat_demand99.htm Aug. 2004.
14. Haibel, G.K. (1990). Out-of-season breeding in goats. Vet. Clin. North Am. Food Anim. Pract. 1990 Nov; 6(3): 577-83.
15. Hart, S. (2001). Types of Fencing for Goats. 2001 Field Day Proceedings. E. (Kika) de la Garza Institute for Goat Research, Langston University, Langston, Ok. <http://www.luresext.edu/goats/library/field/hart01.html> 08/31/04, Aug. 2004.
16. Hart S.P. (2001). Recent Perspectives in Using Goats for Vegetation Management in the USA. *Journal of Dairy Science* 84 (Electronic Supplement): E170-E176. 2001.
17. Harwell, L., and Pinkerton, F. (2000) Meat Goat Production Handbook: Housing, Fencing, Working Facilities, and Predators. Clemson State University. <http://www.clemson.edu/agronomy/goats/handbook/>
18. James, N. A., B. W. Berry, A. W. Kotula, V. T. Lamikanra, and K. Ono. 1990. Physical separation and proximate analysis of raw and cooked cuts of chevon. International Goat Production Symposium, Oct. 22-26, pp.22.
19. Johnson, Severin A., (2002). Goat Briefing: Overall Goat Information. Iowa State University Extension, <http://www.iowaagopportunity.org/goats/goatbriefing.html>. August 2002.
20. Knights, M. and Garcia, G. W. (1997). The status and characteristics of the goat (*Capra hircus*) and its potential role as a significant milk producer in the tropics: A Review. *Small Ruminant Research* 26:203-215.
21. Kosmin, B., A. Mayer, and A. Keysar (2001). "The American Religious Identity Survey." Center for Jewish Studies, City University of New York Graduate Center, www.gc.cuny.edu/studies/arls_index.htm. August 2001.
22. Lu, C. D., and Potchoiba, M.J. (1988). Milk feeding and weaning of goat kids - a review. *Small Ruminant Research* 1:105-112. 1988.
23. Luginbuhl, Jean-Marie (2002). Meat Goats Production. Extension Animal Husbandry, Department of Animal Science, North Carolina State University Cooperative Extension.

24. Luginbuhl, J.M., Green J.T., Mueller J. P., and Poore M.H. (1996). Meat Goats in Land and Forage Management. Proceedings of the Southeast Regional Meat Goat Production Symposium "Meat Goat Production in the Southeast – Today and Tomorrow". February 21-24. Florida A&M University, Tallahassee.
25. Luginbuhl, J.M., Green J.T., Poore M.H., and Mueller J. P. (1996). Use of Goats as Biological Agents for the Control of Unwanted Vegetation. Presented at the International Workshop "Los Arboles en los Sistemas de Produccion Ganadera" [Use of Trees in Animal Production Systems], Indio Hatuey Pasture and Forage Experimental Station, Matanzas. November 26-29.
26. Machen, R.V. (2000). Meat Goat Production – Elements for long-term success. Texas A&M Research and Extension Center Bulletin. <http://uvalde.tamu.edu/staff/Machen6.htm>. August, 2004.
27. Mc Connell, T. (2003). Spreadsheet Templates: West Virginia Goat Budget, 2004. West Virginia University Extension Service. <http://www.wvu.edu/~agexten/farmman2/template/>, September 2004.
28. Mobini, S. (2004). Herd Health Management Program for Goats. Agricultural Research Station, Fort Valley State University, Fort Valley, GA. <http://www.aginfo.fvsu.edu/Database/Publications/ars>, August 2004.
29. Nuti, L., Pinkerton, F., and McMillan, K.W. (2002). Pasture supplementation of post-weaning Spanish and Boer x Spanish kid goats, their live and carcass grades, and market price and consumer responses. Prairie View A&M University (Texas). http://www.jackmauldin.com/slaughter_goat_market.htm Sept., 2004.
30. Nye, T.L., and Moore R. (2002). Meat Goat Production and Budgeting. Ohio State University Extension Factsheet AS-14-02. Columbus, Ohio.
31. Penn State Cooperative Extension Office, (1994). Idea Plan: Sheep Housing, Fencing, Feeders, and Equipment (No. IP 725-24) in the Sheep Housing and Equipment Handbook, MWPS-03-1994. The Pennsylvania State University, 112 Agricultural Administration Building, University Park, PA 16802-2602
32. Pinkerton, F., Harwell, L., Drinkwater, W., and Escobar, N. [A] (1994). Marketing meat goats: Channels, supply and demand. Langston University Goats Research Fact Sheet No. M-03, April 1994.
33. Pinkerton, F., Harwell, L., Drinkwater, W., and Escobar, N. [B] (1994). Consumer demand for meat goats. Langston University Goats Research Fact Sheet No. M-04, April 1994.

34. Pinkerton, F., Harwell, L., Escobar, N., and Drinkwater, W. (1993). Marketing channels and margins for slaughter goats of southern origin. South Regional Development Center, Mississippi State University.
35. Pinkerton, F., Scarfe, D., and Pinkerton, B. (1991). Meat goat production and marketing. E. (Kika) de la Garza Institute for Goat Research, Langston University, Langston, Oklahoma. Langston University Goat Research Extension Publication No. M-01, June 1991.
36. Power, C. (1998). "The New Islam," *Newsweek*, March 6, 1998.
37. Sahs, R. (1998). Goat Farm Budgeting. 1998 Field Day Proceedings. E. (Kika) de la Garza Institute for Goat Research, Langston University, Ok.
38. Schoenian, Susan (2004). General Health Care Of Sheep and Goats. Western Maryland Research & Education Center, Maryland Cooperative Extension. Maryland Small Ruminant Page, <http://www.sheepandgoat.com/Index.html>, August 2004.
39. Shearer, J. K. and Bliss, E. L. (1994). Meat Goat Herd Health Management. University of Florida, Florida Cooperative Extension Service. Fact Sheet VM-39, June 1994.
40. Shelton, M. and Lawson, J. (1982). The Effect of Season on Reproductive Activity of Meat Type Goats in Texas. U. . . Proceedings of the Third International Conference on Goat Production and Disease (Abst.) pp341.
41. Shurley, M. (2002) "Meat"ing the Demand for the American Goat Meat Association. <http://www.meatgoats.com/articles/2002-09meatingthedemand.htm>. October 2004.
42. Stanton, T. (2002). Market Outlook, Export Potential, and Value-Added Processing of Meat Goats and Meat Goat Products, Extension Sheep & Goat Associate. Northeast Sheep & Goat Marketing Program, Cornell University. <http://www.sheepgoatmarketing.org/sgm/education/goatmktl.htm> October, 2004.
43. Walkden-Brown, S. W., and Martin G.B. (1997). Seasonal breeding in sheep and goats: making sense of the diversity of reproductive strategies. *Proc. Aust. Soc. Reprod. Biol.* _28,4.
44. Wheaton, J.E., K.M. Carlson, H.F. Windels and L.J. Johnson (1993). CIDR: A New Progesterone Releasing Intravaginal Device for Induction of Estrus and Cycle Control in Sheep and Goats. *Animal Reproduction Science* 33: 127-142

45. Whitley, N. C. and Jackson D.J. (2004). An update on estrus synchronization in goats: a minor species. J Anim Sci. 2004; E-Suppl:E270-276.
46. U.S.D.A. Handbook #8, 1989.
47. Zajac, Anne (2002). Goat Parasites and their Control. Goat Notes: Meat Goat Expo Proceedings, Virginia State University, 2000.



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